Basic Process of DUI Drug testing in a Toxicology Laboratory.

By Raymond Van Orden – Toxicology Supervisor

Learning Objectives

- Definitions
- Basic Laboratory testing process for DUI drug samples
- What blood and Urine kits look like
- What do the numbers mean
- What can Forensic Scientist Testify about

Definitions

- **Toxicology**
  - The science of the study of poisons
  - Often thought of as the study of the harmful effects of drugs to living systems
  - **Forensic toxicology** is one branch

Definitions

- **Pharmacology**
  - A medical science addressing the interactions between drugs & living systems
  - Often thought of as the study of the beneficial effects of drugs
- **Psychopharmacology**
  - The science of how drugs affect the brain

Definitions

- **Metabolism**
  - The break down of the parent (initial) drug into other products so it can be eliminated by the body (usually forms a water soluble product)

Definitions

- **Metabolites**
  - A chemical substance derived from a drug
  - Created by the actions of the body on the drug
  - May or may not be psychoactive & the name may not appear on the drug schedule
  - May point to a specific drug, or a group of related drugs

Definitions

- **Forensic Toxicology**
  - The analysis of drugs & poisons in biological materials & the application of the findings to the law
  - ABFT defined forensic toxicology as: “the study and application of toxicology to the purpose of the law”

Forensic Toxicology

- **Not all Drugs Affect the Central Nervous System or Cause Impairment**
  - Those that do not are generally not tested for
  - The DRE Program is concerned with those that do

Forensic Toxicology

- **Two Roles that assist Prosecutors and Law Enforcement**
  - Analysis of biological specimens for drugs/metabolites
    - Positive results are **factual** information
  - Interpreting the analytical findings

Forensic Toxicology

- **Can assist other ways**
  - Consult with the prosecutor or DRE to educate about the expected effects of the drug(s)
  - Consult to help meet defense challenges
  - Answer questions, serve as a resource

Forensic Toxicology

- **Help the Toxicologist**
  - Meet prior to trial to discuss expected issues
  - Keep informed of trial schedules
    - Will need to review material regarding the specific drug(s)
  - Keep informed of defense arguments discussed pre-trial or raised in opening statement, etc.

Forensic Toxicology

- **AZ labs are accredited, which means**
  - Are following policies and procedures
  - Meet accreditation standards ANAB 3125 and ISO/ICE 17025:2017
  - Laboratory has an external audit done every two years and an internal audit every year
  - Complete proficiency tests

TOXICOLOGY AND THE DRE PROGRAM

TOXICOLOGY IS THE 12TH STEP
IN THE DRE EVALUATION PROCESS

DETERMINE IF CHEMICALS ARE
PRESENT IN THE SAMPLE

Forensic Toxicology

- This does not mean the DRE needs to wait until step 12 to collect the blood or urine sample.
- The sooner the sample is collected the better.
- The DRE forms an opinion prior to toxicological testing.

Forensic Toxicology

- Primary function of toxicological analyses in a DRE case is to determine if drugs are present in the sample.
- The toxicologist should help tie the results of the DRE examination to the toxicological results.

Role of the Forensic Toxicologist

- Corroboration
- Quality Assurance
- Expertise/Knowledge

Role of the Forensic Toxicologist

- Meet Prior to Trial – Potential discussions
  - Which drugs were or were not tested for?
  - Which tests were performed and by whom?
  - Who will /should testify and what are they qualified to testify about?
  - What, if any, quantitative analysis was performed?
  - If yes, what does this indicate?
  - Overall, what do the laboratory results mean?
  - Are there any problems?
  - How familiar is the toxicologist with the DRE program?
  - Do the lab results fully or partially support the DRE opinion?
  - Should the toxicologist review the DRE evaluation report?
  - If so, what additional opinions, if any, can the toxicologist reach?
  - Is a portion of the specimen available for defense testing?
  - How do you pronounce the names of the drugs?

Limitations of Toxicology

Straightforward correlations between drug levels & impairment do not exist

- No “per se” levels above which they can be considered impaired or below which considered not impaired
- For drugs other than alcohol, the lab cannot routinely determine impairment using the drug levels

Limitations of Toxicology

The metabolism of drugs (other than alcohol) is complex

- The elimination rate of drugs from blood is generally non-linear (first order)

Drugs have not been studied as much as alcohol

- Many drugs to study
- Ethical considerations

Limitations of Toxicology

The primary purpose of toxicology in the DRE program is to test for the presence of drugs, not to determine impairment

The toxicological tests generally are not intended to determine:

- the time of drug use
- amount of drug used
- resulting impairment

Limitations of Toxicology

What is impairment then?

- For drugs (other than alcohol) impairment is not a number
- It is the reduction in ability to perform a task (e.g., driving)
- It is a state, a condition, a behavior
- Impairment is observable - an observable set of signs and symptoms

Limitations of Toxicology

Prove Impairment Through the Signs and Symptoms That Were Exhibited and Observed

Use Toxicology to Corroborate the Impairment and Tie it all Together

Limitations of Toxicology

Prescription drugs can and will cause impairment

- even when taken in recommended dose
- large therapeutic range
- When abused, really high levels
- When mixed with alcohol can have synergistic effects 1 + 1 = 5

Testing Process

- Screening and confirmation analysis

Testing Process

- Screening Test
  - Rapid presumptive test which identifies drug classes (usually not the specific substance present)

Testing Process

Screening Techniques

- Enzyme Linked ImmunoSorbent Assay (ELISA)
- Gas/Liquid Chromatography Mass Spectrometry or Tandem Mass Spectrometry (GCMS or LCMS)
- Time of Flight Mass Spectrometry (TOF)

Testing Process

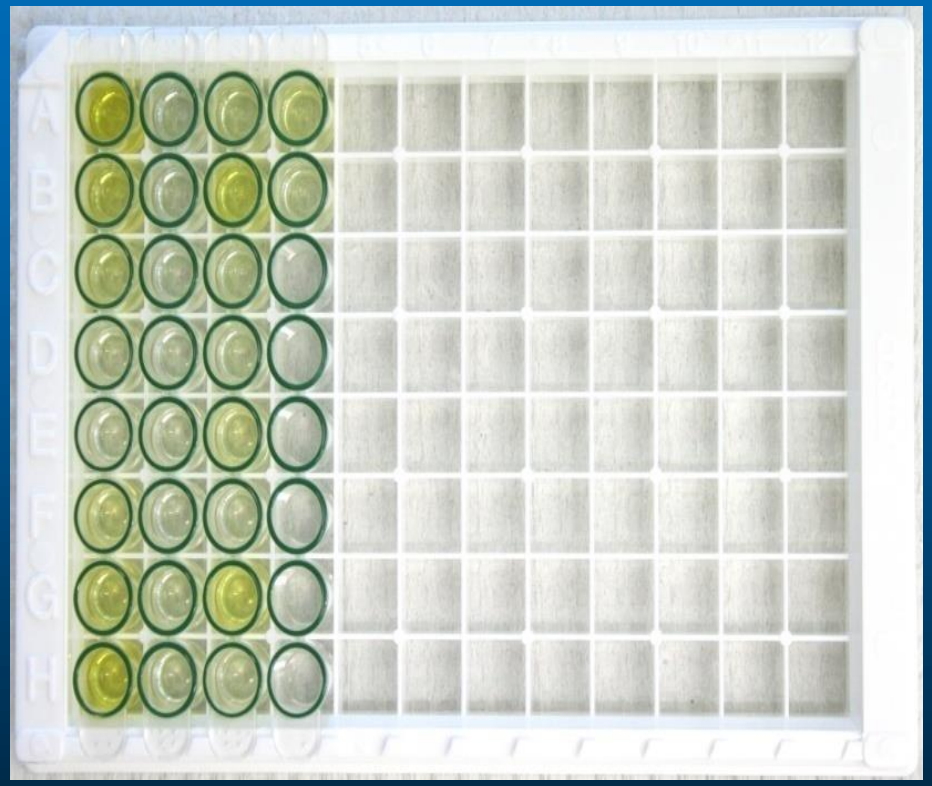
ELISA

Testing Process

ELISA

- Targets drug categories
- Drugs cross react
- Test for large number of drugs, short time

Testing Process



Testing Process

DOA Ultra WB Array Report

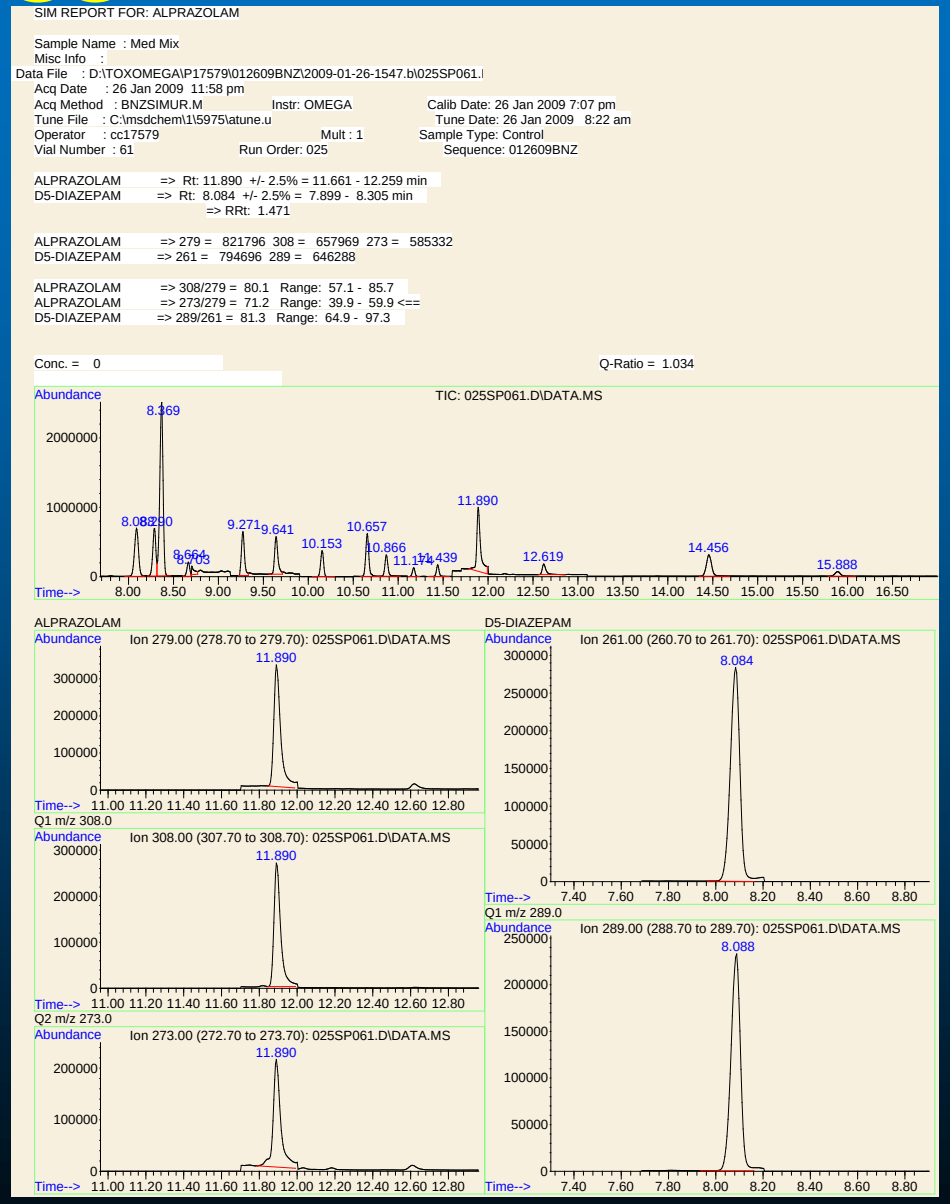
Array Details: DOA Ultra WB Array
Sample(s) Run By: Lela Fokumlah
Batch Details: 0756
Date of Sample(s): 12/17/2018
Date of Calibration: 12/17/2018 04:55 PM
Calibrator Lot No: 0756

SampleCode	(DF)	ng/ml OXYC1	ng/ml OXYC2	ng/ml DMP	ng/ml MPB	ng/ml MAMP	ng/ml BARB
20183000722-1496365-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-1.2(<50)
20183000758-1495086-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-1.42(<50)
20183010039-1495090-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183010606-1495216-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-0.39(<50)
20183010696-1495291-AA	4	-(<0)	-0.29(<10)	-(<0)	-(<0)	-(<0)	-(<0)
20183020020-1495243-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-0.56(<50)
20183030649-1495831-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183030772-1495892-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
Control 1	4	-3.92(<10)	-5.79(<10)	-3.43(<5)	*+108.96(>100)*	-17.57(<20)	-34.3(<50)
20183030819-1495902-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183040065-1495925-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183040556-1496105-AA	4	-1.38(<10)	-0.09(<10)	-(<0)	-(<0)	-(<0)	-(<0)
20183040592-1496148-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-1.38(<50)
20183040594-1496145-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	*+(>200)*	-(<0)
20183040622-1496374-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183040669-1496166-AA	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)
20183040685-1496112-AA	4	-(<0)	-0.01(<10)	-(<0)	-(<0)	*+(>200)*	-(<0)
NQC	4	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)	-(<0)

Testing Process

GCMS or LCMS

- Scan for drugs, less sensitive than a targeted approach in confirmation analysis
- Get full spectrums or parent molecular weight



Testing Process

GCMSMSMS

Or

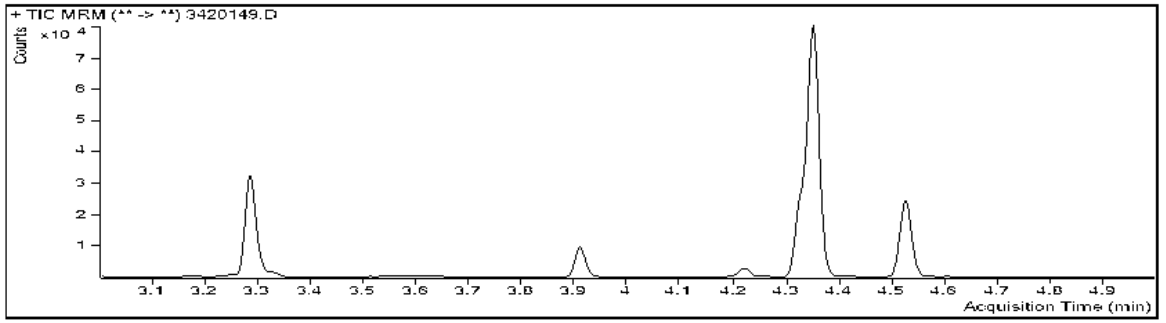
LCMSMSMS

- Targeted analysis
- Very sensitive
- Cannot find unknowns

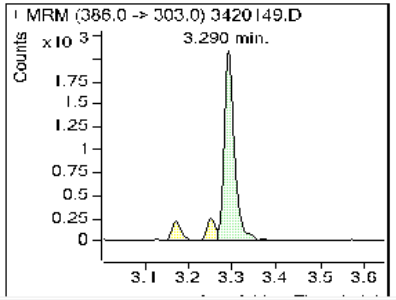
Quantitative Analysis Sample Report

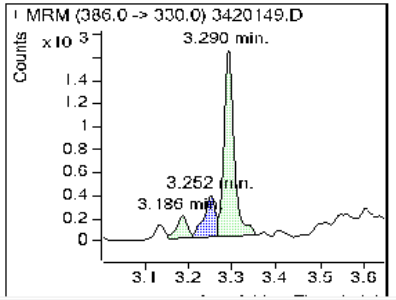
Data File	:	3420149.D
Operator	:	TH 11775
Acq Method Name	:	THC MRM
Acquisition date	:	2019-02-07 00:36
Sample Name & Path	:	20183420149, D:\ToxCrockett\11775\020619THCCR\
Vial	:	45
Dilution	:	1
Sample Info	:	
Tune File	:	atunes.eiex.tune.xml
Tune Date	:	2019-02-06 19:18
Quant Batch Version	:	Batch was analyzed in B.06.00SP01 Report was generated in B.06.00 SP01
Last Calib Update	:	2019-02-07 07:33

Cmpnd	Signal	RT	Limits	Response	QRatio	Limits	FinalConc
THC	386.0 -> 303.0	3.29	3.14 - 3.47	3398			3.26
	386.0 -> 330.0			2635	77.5	69.6-104.4	
D3-THC	389.0 -> 306.0	3.29	3.13 - 3.46	18379			
	389.0 -> 330.0			15944	86.8	68.0-102.0	
THC-OH	371.0 -> 289.0	3.91	3.73 - 4.12	5676			1.4
	371.0 -> 305.0			4111	72.4	60.1-90.1	
THC-COOH	371.0 -> 289.0	4.36	4.15 - 4.59	68519			34.92
	488.0 -> 297.0			18648	27.2	22.4-33.6	
D9-THC-COOH	380.0 -> 292.0	4.33	4.13 - 4.56	20286			
	497.0 -> 306.0			5619	27.7	21.6-32.4	



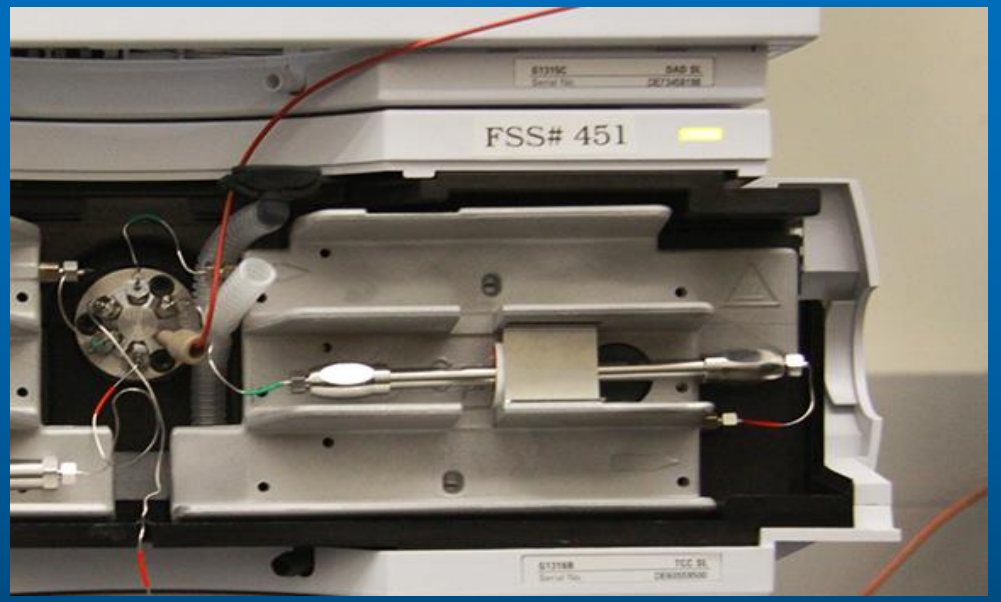
THC

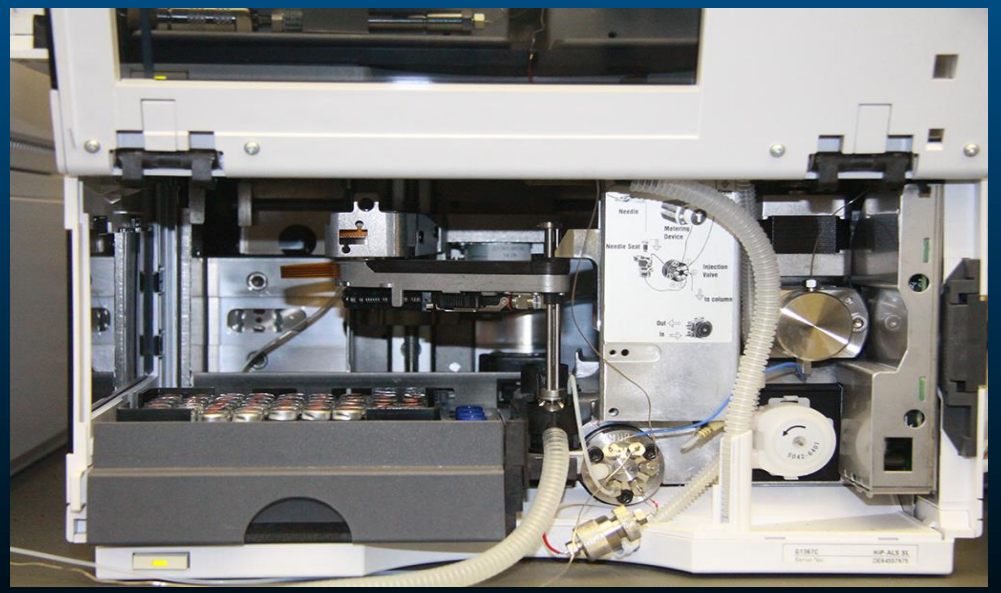




Confirmations

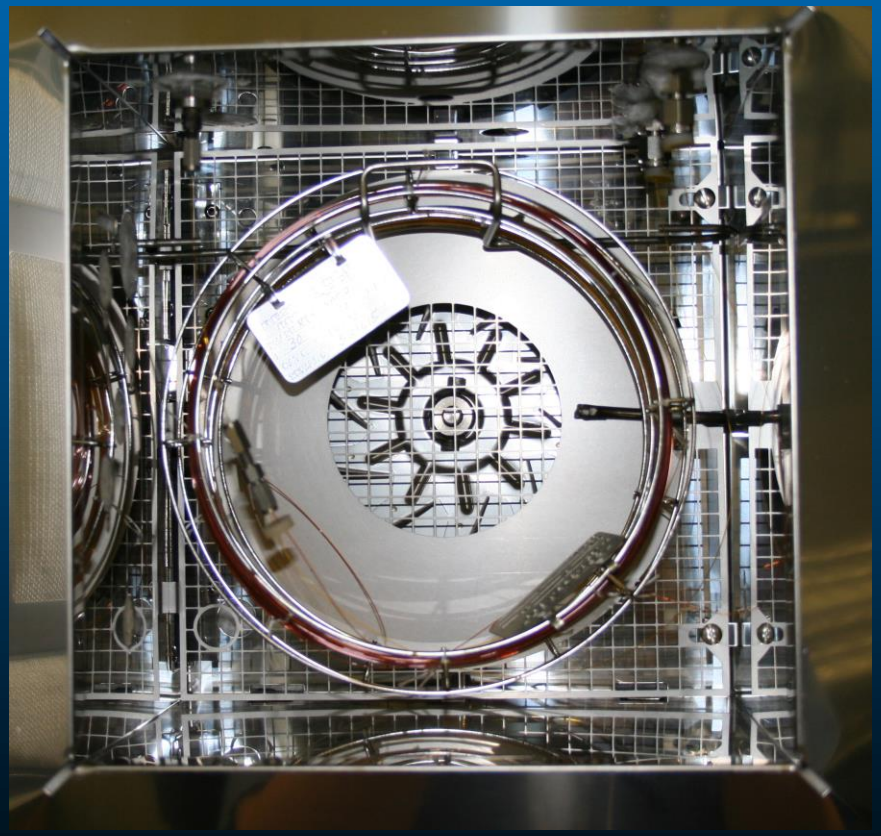
LCMSMSMS





Confirmations

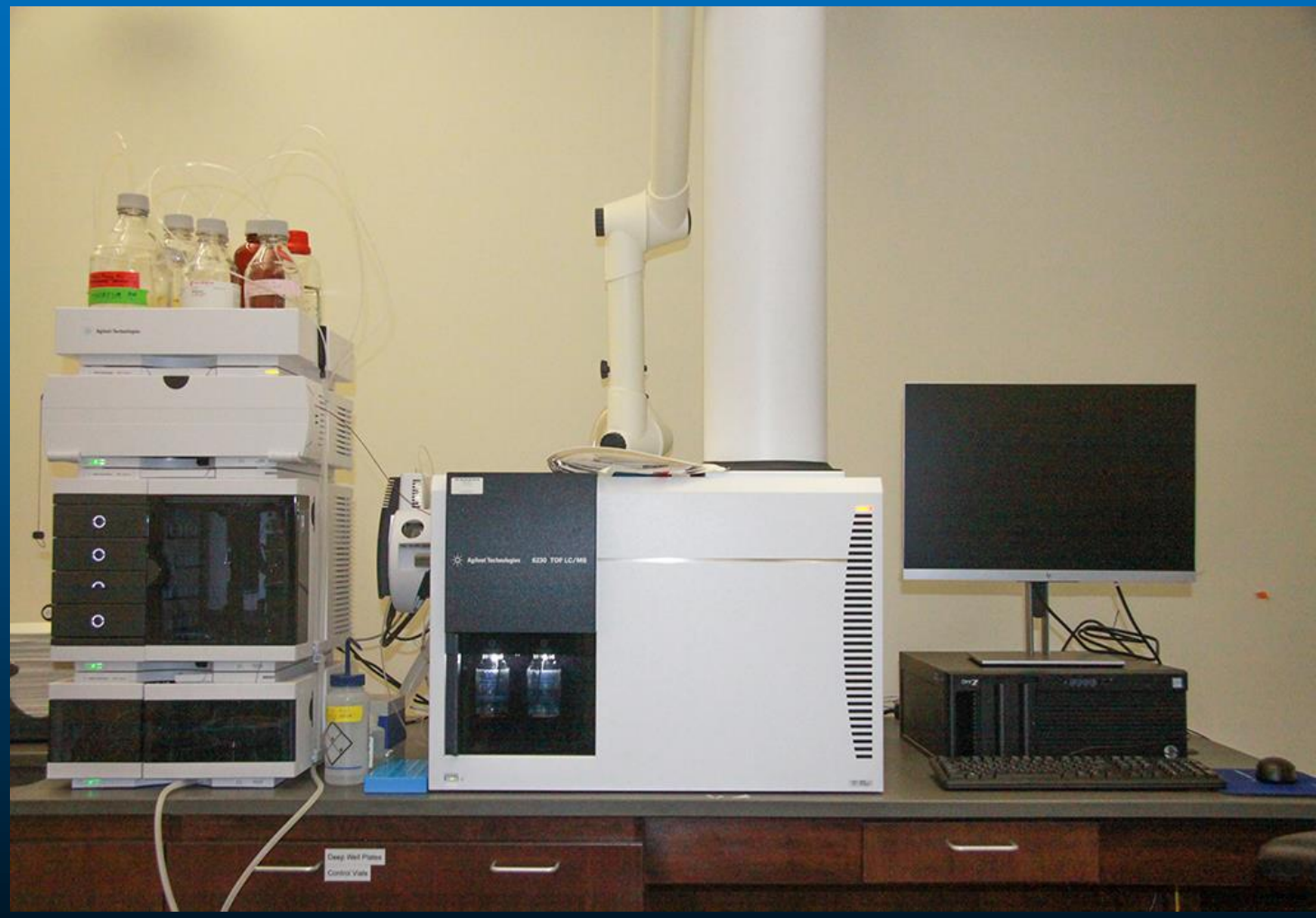
GCMSMSMS



Testing Process

LC-TOF

- Identifies drugs by accurate mass
- Sensitive
- Can find and identify unknowns



Testing Process

Confirmation techniques

- Gas/Liquid Chromatography Mass Spectrometry (GCMS or LCMS)
- or Tandem Mass Spectrometry (GCMSMSMS or LCMSMSMS
- Time of Flight Mass Spectrometry (TOF)

Testing Process

Confirmation techniques

- Have calibration lines
- Cut off value or threshold concentration
- Quantitative results

What do the numbers mean?

The numbers do not mean much

- The observed and documented impairment is very important
- Therapeutic ranges are large, therapeutic means the drug is having an affect on the body in some form
- Do not get stuck on a quantitative level, impairment can & often is still there
- The laboratory is there to support the Officer's observations and the DRE's opinion

DUI Blood/ Urine Kits

DUI Blood/ Urine Kits

Blood

- Relatively easy to collect
- Circulating in the body, thus a better indicator of impairment
- Parent drug detection, e.g., THC
- Quantitative; actual concentration

Urine

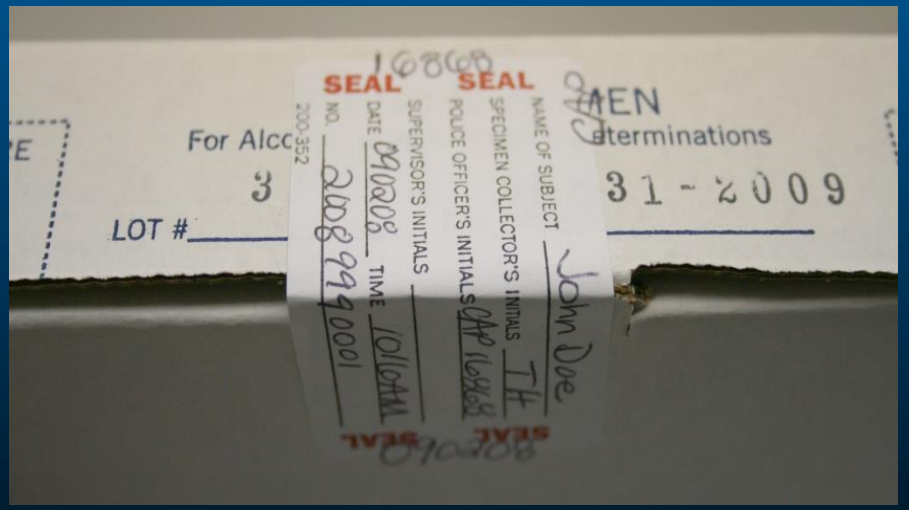
- Waste product
- Usually drug metabolite detection, e.g., THC-COOH
- Qualitative; positive/negative

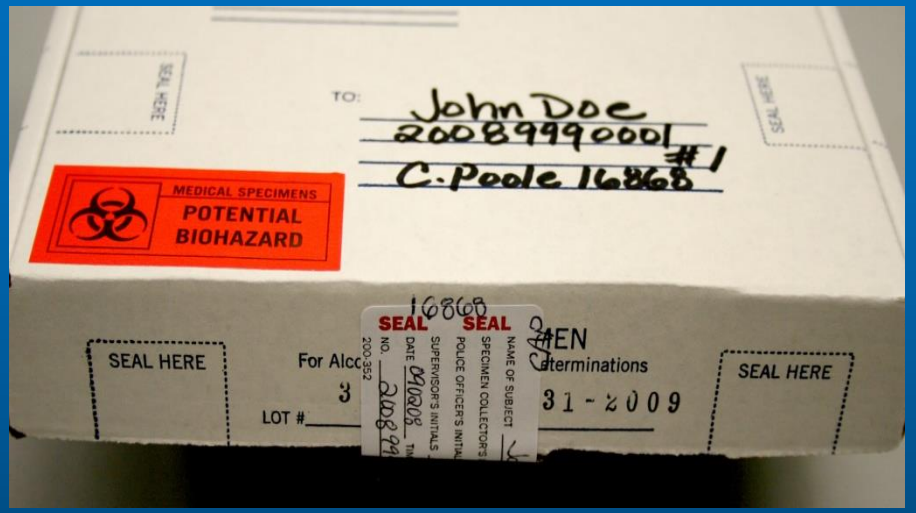
DUI Blood/ Urine Kits

- All blood/urine samples will be analyzed for alcohol first (unless "No BAC" is requested).
- If the BAC is <0.085%, the blood/urine sample will automatically be screened for drugs (Mesa protocol).
- The blood/urine will be analyzed for drugs depending on other factors as well. (Requested)

Blood Kit Labeling

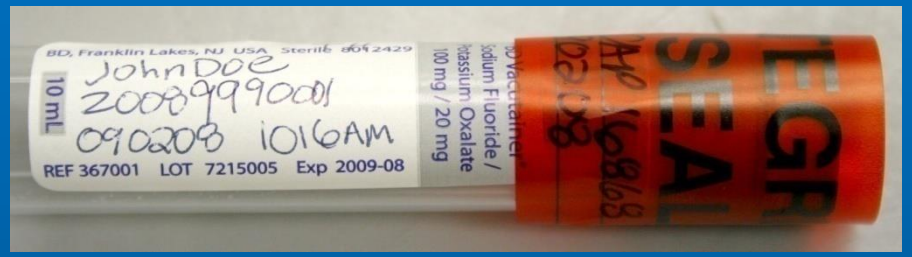
- One white seal on the cardboard box with initials, ID, and date on the edge of the seals





- Subject name, DR#, Item#, and Officer's name written on the box

Blood Kit Labeling

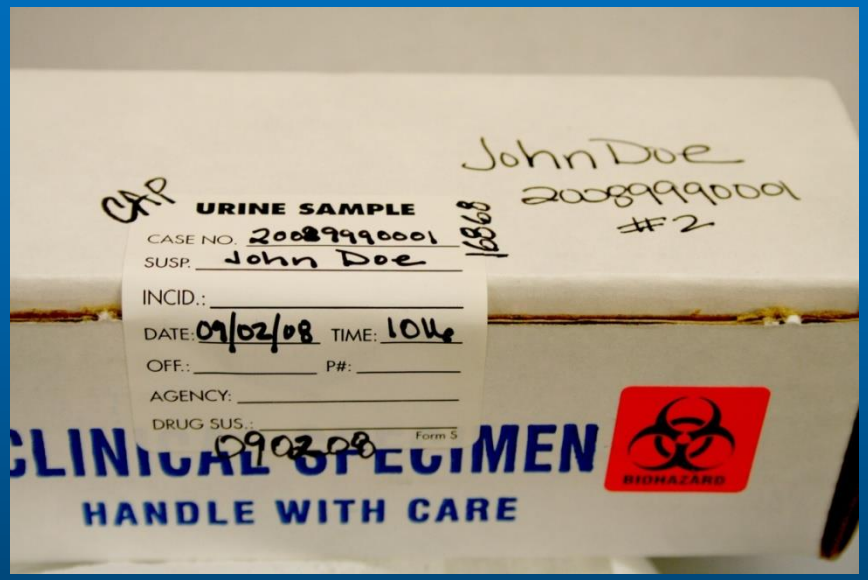


- DR#, Subject name, date and time of collection, and blood collector's initials on the tube

- Red integrity seals on the tops of the tubes with initials and date

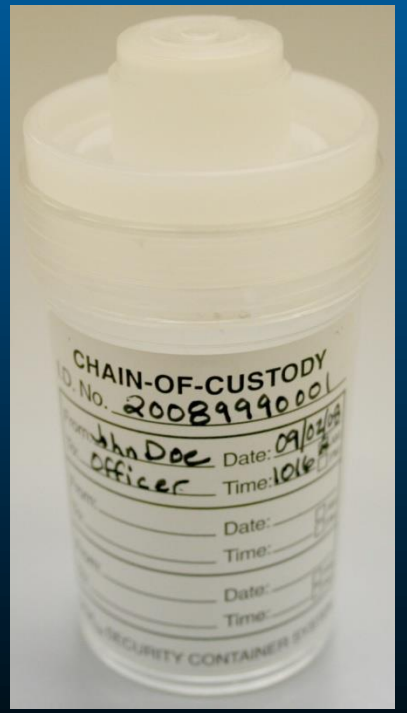
- Two white seals on the plastic box with initials, ID, and date

Urine Kit Labeling



- Subject's name, DR#, Officer's name, and Item# on the box
- Urine Sample seal used to seal the box
- Initials, ID#, and date on the edge of the seal

- Chain of Custody sticker used to label the container
- DR#, Subject's name, and date and time of collection written on the label



DUI Blood/ Urine Kits

- Analyst will label box
- Label the tube that is tested

Toxicology Testimony

ASB Best Practice Recommendation 037:

Guidelines for Opinions and Testimony in Forensic Toxicology

http://www.asbstandardsboard.org/published-documents/

Toxicology Testimony

- Intended for the subdisciplines of human performance toxicology, postmortem toxicology, non-regulated employment drug testing, court ordered toxicology, and general forensic toxicology .

- Forensic toxicologists are called to testify in criminal and civil matters to discuss analytical results and offer their expert toxicological opinion

- Developed to provide general guidance to expert witnesses called to testify on the topic of forensic toxicology, to include the expert toxicological opinions they may offer.

Toxicology Testimony

A Toxicologist May:

- discuss a laboratory report and any analytical work that supports that report. Applicable limitations should be addressed.

- qualify a reported concentration in the context of a given case as subtherapeutic, therapeutic, toxic or lethal when that statement can be backed by appropriate references, databases and/or other relevant information.

Toxicology Testimony

A Toxicologist May:

- address pharmacokinetics/toxicokinetics and/or pharmacodynamics/toxicodynamics of drugs or other chemicals.

- discuss the toxicological impact of the presence or absence of drugs or other chemicals

Toxicology Testimony

A Toxicologist May:

- address impairment for the average individual to the extent that effects are consistent with documented pharmacodynamic and toxicodynamic properties of the substance and within the context of a given case.

- perform or discuss toxicological calculations that are generally accepted in the field and can be supported by research and references, provided appropriate limitations are cited.

Toxicology Testimony

A toxicologist should not:

- should not address behavioral intent based solely upon a drug concentration.
- should not opine as to a specific individual's degree of impairment based solely on a quantitative result.

Toxicology Testimony

A toxicologist should not:

- should not imply impairment of an individual based on analytical findings from urine, hair or other matrices unless supported by the literature.
- should not opine as to the absolute cause of an accident.
- should not perform back-extrapolation calculations for drugs other than ethanol.

Toxicology Testimony

A toxicologist should not:

- should not calculate the dose of a drug (with the exception of ethanol) through body burden calculations.

Toxicology Testimony

A toxicologist should not:

- should not opine as to the effects of a drug or combination of drugs on a specific individual without context of a given case.

- should not use words such as “scientific certainty” or “reasonable degree of scientific certainty”, unless required by jurisdictional regulations.

Summary

- The toxicologist and lab results are a small part of the prosecution, but an important one.
- The laboratory does screening and confirmations. Usually are two different and independent results to create the final lab report.
- Will corroborate the impairment that the officer and/or DRE observed

Questions

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